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## If they have no leaves, let them eat bread? — A remarkable food habit in the cotton bollworm *Helicoverpa armigera* (Hübner) (Lepidoptera, Noctuidae)

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**Abstract** A late-instar larva of the cotton bollworm *Helicoverpa armigera* (Hübner) was found feeding on bread in a residential home in Osaka. The larva may have inadvertently invaded the house, or earlier the grocery store or bakery, to ultimately feed on the bread. The larva was subsequently reared on the bread in the laboratory, but it died before pupation. This occurrence represents a rare case of the infestation of a processed cereal food by a macrolepidopteran caterpillar and the second report of bread-feeding in the cotton bollworm. *Helicoverpa armigera* caterpillars typically feed on leaves and flowering plant parts, including seeds, and prey on caterpillars. The wide host range and the tendency to feed on proteinous materials of *H. armigera* may explain this bizarre feeding behavior.

**Key words** feeding habit, *Helicoverpa armigera*, Heliothinae, polyphagous caterpillar, processed cereal food.

A small fraction of lepidopteran species infest stored cereals and processed cereal foods. These species are dominated by several members of the microlepidoptera, such as Pyralidae, Tineidae, Oecophoridae, and Gelechiidae (Robinson, 2005; Japanese Society of Applied Entomology and Zoology, 2006). These species are never found feeding on leaves in the field. In fact, the natural habitats of stored-product pests generally include sheltered sites where seeds and nesting materials have been gathered by rodents, birds, or other insects (Plarre and Burkholder, 2009), although many brucid beetle pests attack seeds on outdoor plants. We had an opportunity to inspect a noctuid caterpillar, whose normal diet includes living plant tissues such as fresh leaves, that was found feeding on bread indoors. Here, we describe the observed behavior and potential reasons for its occurrence.

In late May 2005, a late-instar noctuid caterpillar (nearly 30 mm in length) was found feeding on bread in a residential home in Osaka. The bread had been purchased in a grocery store a few days prior in Osaka. We were asked to identify the larva on 31 May 2005. The senior author identified the larva as the cotton bollworm *Helicoverpa armigera* (Hübner) (Lepidoptera, Noctuidae), based on Yamamoto (1987) and Yoshimatsu (2001). The larva was subsequently reared on the bread in a 500-mL plastic container in the laboratory. The larva continued feeding on the bread and excreted several, light-brown fecal pellets for a week. However, the larva unfortunately died without pupating due to malfunction during ecdysis.

*Helicoverpa armigera* is a well-known agricultural pest worldwide; it infests various crop plants such as cotton, maize, sunflower, and soybean (Yamamoto, 1987; Zhang, 1994; Robinson *et al.*, 2001; Japanese Society of Applied Entomology and Zoology, 2006). Therefore, this finding represents a rare case of the infestation of processed cereal food by a macrolepidopteran caterpillar that usually feeds on fresh leaves. To our knowledge, only one record exists

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of bread-eating in *H. armigera* larva. Hashimoto (1995) reported that a late-instar larva was found feeding on French bread in Osaka and that the larva successfully grew into an adult while feeding on the bread. However, the eclosed adult was smaller than field-caught specimens (Hashimoto, 1995). The rearing record of Hashimoto (1995) and the present report point to the inadequacy of bread constituents for *H. armigera* larvae.

Casimero *et al.* (2000) examined the suitability of various crop leaves and the artificial diet Insecta LF (Nihon-Nosan Kogyo Co.) for *H. armigera* larvae. They documented that Insecta LF is the best food for larval survival and weight gain. Insecta LF contains water (72–76%), protein ( $\geq 6.0\%$ ), fiber ( $\leq 4.0\%$ ), fat ( $\geq 1.0\%$ ), and vitamins and minerals (Nosan Corporation, 2006). Bread contains a high proportion of carbohydrates (45–57%) and protein (8–10%) but less water (30–38%) and vitamins and minerals compared to vegetable leaves and Insecta LF (Yamaguchi, 2001). Judging from the period (possibly 2–3 days) between bread production and the discovery of the larva, the larva had conceivably grown to a late instar while feeding on more suitable food sources than bread, inadvertently invaded the house, grocery store, or bakery, and was then found feeding on the bread in the absence of leaves.

Although *H. armigera* larvae feed mainly on leaves of various plant species, they occasionally eat unusual materials. Hayashi (2000) reported that larvae preyed upon conspecific larvae and the larvae of *Papilio machaon* L. (Lepidoptera, Papilionidae) and *Pieris brassicae* (L.) (Lepidoptera, Pieridae) during a dry autumn in France. In addition, when she provided beef and lamb to the larvae, they also consumed these materials (Hayashi, 2000). In general, members of the subfamily Heliothinae, including *H. armigera*, preferentially feed on proteinous food sources, such as flowers and fruits, in addition to leaves, and they sometimes prey on other caterpillars (Hardwick, 1965; Boyd *et al.*, 2008). Although bread may not be an optimal food for *H. armigera* larvae, it contains more protein than fresh leaves (Yamaguchi, 2001). Thus, the polyphagous habit and preference for proteinous foods in *H. armigera* may explain this bread-feeding behavior.

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## 摘要

葉がなければパンを食べる?—オオタバコガ幼虫の奇妙な食性—(山崎一夫・高倉耕一・今井長兵衛)

オオタバコガの幼虫が大阪市の家屋内でパンを摂食しているところを見出された。この幼虫は偶然に人家、食料品店、あるいはパン製造所のいずれかに侵入し、パンを見つけて摂食にいたったものと考えられる。この幼虫はそのままパンを食餌にして飼育したが、蛹化せずに死亡した。本報告は大蛾類が加工穀物食品を加害した稀な報告例であり、本種のパン食の記録としては2例目である。本種は葉以外に花や果実などを好んで摂食する習性があり、鱗翅目幼虫を捕食することも知られている。本種において稀にパン食が見出されるのは、多食性とタンパク質を多く含む食物を選好する習性が原因なのかもしれない。

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